

Habitat Fragmentation

A Bird's-Eye View



Objectives:

Student will be able to:

- recognize that different species respond differently to perturbations in their environment
- work collaboratively to generate possible solutions to the problem of conserving biodiversity in a human-managed ecosystem

Author

Ecology Explorers Education Team, adapted from M Dixon and "Interpreting Landscape Patterns from Organism-based Perspectives," by S. M. Pearson, Chapter 13 in Gergel and Turner (2002. Learning Landscape Ecology, Springer-Verlag)

Time:

60 minutes

Grades:

6-12

Standards

Arizona Science

Personal & Social Perspectives; Life Sciences

NGSS - Core Ideas

Human Impacts; Interdependent relationships in ecosystems; Ecosystem dynamics; Biodiversity and humans

Practices

Using models; Designing solutions

Specific AZ, Common Core, and NGSS standards on page 2.

Background:

Different species of birds use different parts of a habitat. For example in forests, some species prefer the open habitats created by the death of a tree or harvesting of trees. Some species prefer the habitat found in a closed canopy. Some species require large areas for hunting and finding mates. All of these different features of a natural ecosystem can be affected by the amount and pattern of man-made landscape changes. In urban Phoenix, some native desert birds can only be found in the desert outside the city, while others have moved into our city center. As the city expands, the desert retreats. This activity explores the effects of specific patterns of urbanization on various bird species.

Materials:

- handouts include: habitat rules for some bird species (exercise 1), Table 1.1, gridded maps of habitats with different amounts of cleared land, gridded maps with different patterns of forest clearing,
- graph paper and
- calculators (if desired)

Recommended Procedure:

Engagement:

- 1) Have students brainstorm possible effects of urban development on native Sonoran Desert birds. List on the board.
- 2) Go over the habitat requirements for the birds in this activity

Exploration:

Exercise 1:

1. Pass out student worksheet
2. Using the gridded landscape maps for Exercise 1, identify and mark all the cells of suitable habitat based on the habitat rules for your species.
3. Count the number of suitable cells and estimate the % of the total desert habitat (or city habitat for Inca Dove) that is still suitable for your species as the desert shrinks. Fill in this information in Table 1.1.

Explanation

4. Discuss results of Exercise 1. Graph the results for each bird and compare the differences. How does this graph relate to extinction rates?

Expansion

Exercise 2:

- 5) Assuming that 50% of the desert is to be converted into housing, what are the effects of alternative spatial patterns? Follow the directions for exercise two and answer the questions on the worksheet.

Evaluation:

- Collect and grade worksheets

Standards**Arizona Science Standards**

S3-C1-PO4

S3-C1-PO5

S4-C3-PO1

NGSS Core Ideas

ESS3.C: Human impacts on Earth systems

LS2.A: Interdependent relationships in ecosystems

LS2.C: Ecosystem dynamics, functioning, and resilience

LS4.D: Biodiversity and humans

NGSS Practices

Asking questions

Developing and using models

Constructing explanations

Designing solutions

Engaging in argument from evidence

Obtaining, evaluating, and communicating information

NGSS Crosscutting Concepts

Patterns

Cause and effect

Scale, proportion and quantity

Systems and system models

Stability and Change

AZCCRS/ELA Literacy

RST7: Integration of knowledge and Ideas

SL1: Comprehension and Collaboration

AZCCRS/Mathematics

Domains: Number and Quantity, Measurement and Data

Math Practices:

4. Model with mathematics.

8. Look for and express regularity in repeated reasoning.

Student Worksheet

Exercise 1



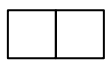
Exercise 1:

Using the gridded landscape maps for Exercise 1, identify and mark all the cells of suitable habitat based on the habitat rules for your species.

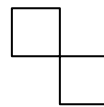
Count the number of suitable cells and estimate the % of the total desert habitat (or city habitat for Inca Dove) that is still suitable for your species as the desert shrinks. Fill in this information in Table 1.1.

Habitat "Rules" for different species

Species	Functional Group	Habitat Rules
Le Conte's Thrasher	Interior Desert Species	Desert cells that do not share a border with an urban cells
Black-Throated Sparrow	Area-sensitive Desert Species (small home range)	Desert patches composed of at least 3 connected cells
Rock Wren	Area-sensitive Desert Species (large home range)	Desert patches composed of at least 9 connected cells
Gilded Flicker	Urban Edge Species	Desert cells that share a border with an urban cell
Inca Dove	Urban habitat Species	Urban cells that do not share a border with a desert cell



These cells are connected and share a border



These cells are not connected and do not share a border

Student Worksheet

Table 1



Table 1.1.

A. # of urban cells	B. # desert cells left	Available Habitat														
		Thrasher		BT Sparrow		Wren		Flicker		Inca Dove						
		C. # suitable cells	D. % of desert cells available (C/B) x100	E. # suitable cells	F. % of desert cells available (E/B) x100	G. # suitable cells	H. % of desert cells available (G/B) x100	I. # suitable cells	J. % of desert cells available (I/B) x100	K. # suitable cells	L. % of urban cells available (K/A) x100					
10%	90															
20%	80															
40%	60															
60%	40															
80%	20															

Student Worksheet

Exercise 2



Exercise 2.

Assuming that 50% of the desert is to be converted into housing, what are the effects of alternative spatial patterns? Based on what you learned in Exercise 1, rank the relative suitability of each of the Exercise 2 landscapes for your species.

Table 2.1

Clearing Pattern	Rank of Habitat Availability for each Species (1=most available, 6=least available)				
	Thrasher	Sparrow	Wren	Flicker	Inca Dove
A. Checker-board (Uniform)					
B. Random					
C. Dispersed strips					
D. Four areas					
E. Progressive strips					
F. Two areas					

Compare and discuss your results with the class. Which species would have the most available habitat on each map?

Discussion Question:

How would you manage the landscape to best accommodate the habitat requirements of all of the species?

Student Worksheet

Landscape Map - Exercise 1



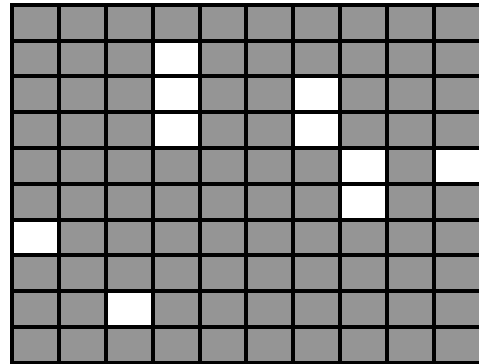
Landscape Maps for Exercise 1

KEY:

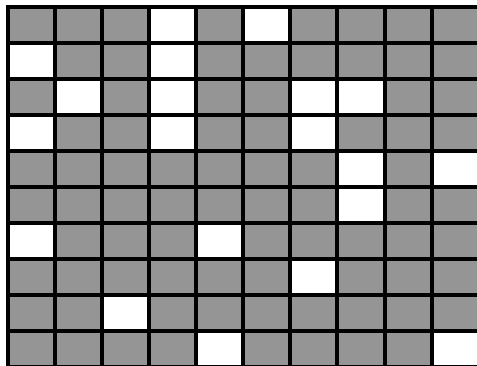
- Gray cells = desert
- White cells = urban

10% = % of desert cleared

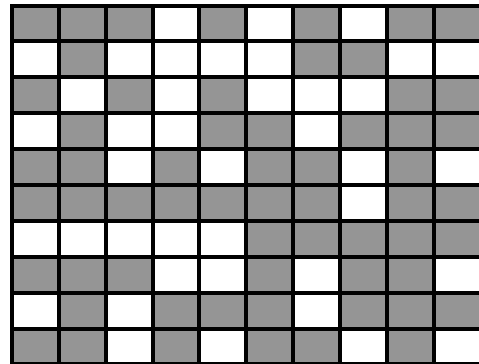
10%



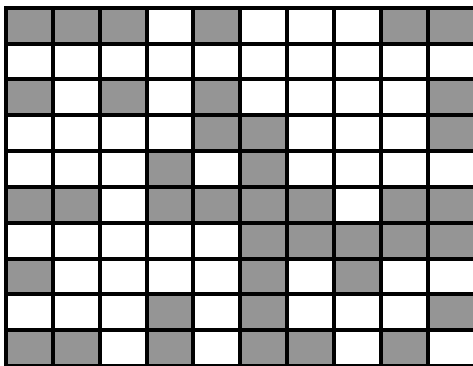
20%



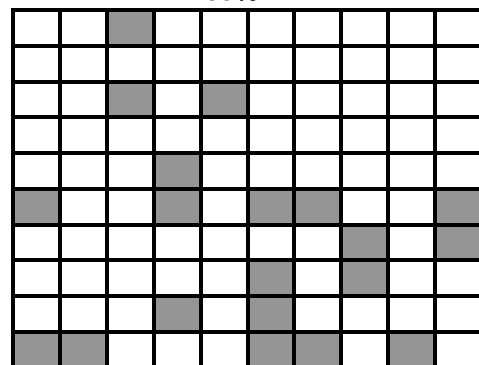
40%



60%

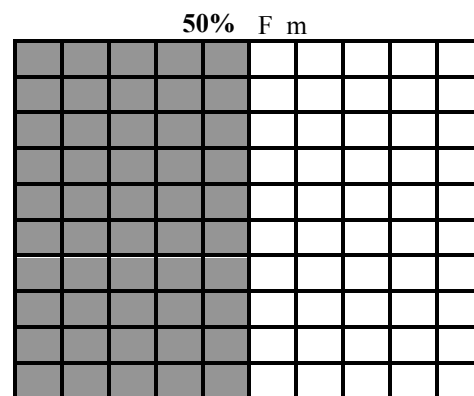
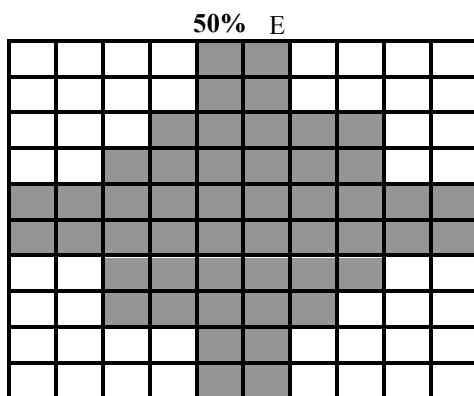
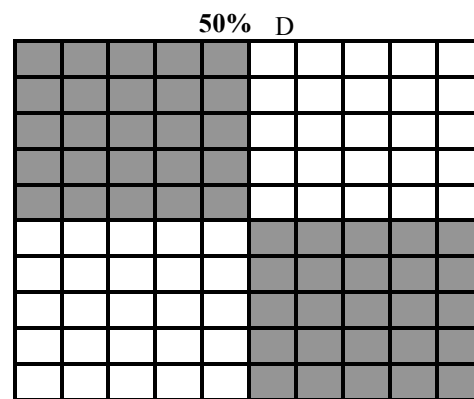
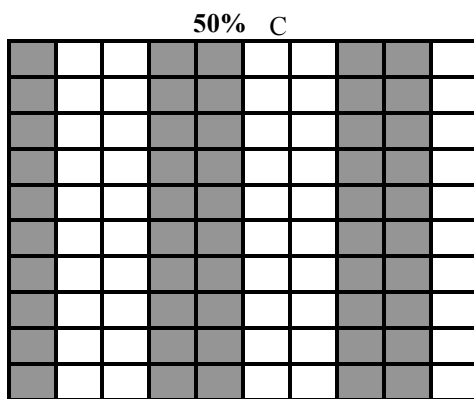
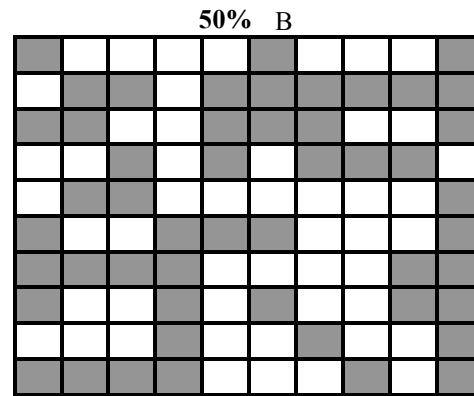
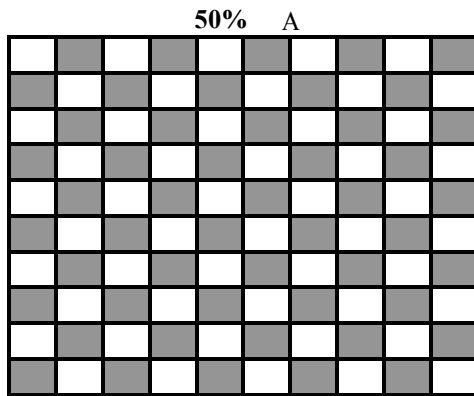


80%



Each of the above landscapes is composed of 100 cells. The progressive placement of clearings was random.

Landscape Maps for Exercise 2



Each of the above landscapes is composed of 100 cells. The progressive placement of clearings was random.